Answers to ‘Coronal Holes’ Quiz

1. What is solar wind?

The solar wind is a stream of charged particles (protons, electrons, Helium ions) that is constantly emanating from the Sun. It takes about 4 days to travel from the Sun to Earth.

2. What is a coronal hole?

Coronal holes are associated with rapidly expanding "open" magnetic fields along which the solar wind flow can easily escape. They appear as dark regions in solar extreme ultraviolet (EUV) and X-ray images due to the lower density and temperature compared to the surrounding corona.

3. What is a high speed stream (HSS), and how is it related to a coronal hole?

A high speed stream is high speed solar wind originating from a coronal hole on the Sun.

4. What are the typical speeds of the typical slow solar wind? What can be the speed of a high speed solar wind stream?

Typically at 1 AU, the slow solar wind speeds are <450 km/s. HSS speeds can be as high as 800 km/s.

Answers to Optional Homework

1. Characteristics of Coronal Holes

- EUV observations: CHs appear dark in the solar corona since they are less dense
- Have an open magnetic field - ionized atoms (protons and alpha-particles) and electrons escape to IP space.
- Generate a faster than average solar wind flow (800 km/s vs. 300 km/s), so-called high speed solar wind streams (HSS)
- Interaction of fast and slow solar wind streams compresses plasma / magnetic field
- Different patterns of solar wind are observed with in-situ instruments at Earth
- Shape the conditions in IP space for the propagation of CMEs; may affect propagation direction of CMEs

2. What is the distinction between the coronal hole and the filament channel?

Both appear as dark coronal features.
- Coronal holes are regions of unipolar magnetic field.
- Filament channels are bipolar fields, consisting of closed (flux rope) magnetic field lines where plasma can be collected to finally form a filament.

3. What are stream interaction regions (SIRs) and corotating interaction regions (CIRs)?

A SIR is the region formed at the compressed boundary between the fast and slow solar wind in a high speed stream. If the flow pattern is roughly time-stationary, these compression regions form spirals in the solar equatorial plane that corotate with the Sun become CIRs, Corotating Interactive Regions.